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Column 463

Snowshoe hares might have something to teach us about stress

by Sarah Locke

We humans might think that we have a lock on issues around stress, and have written the book on living in a stress-filled world. But animals also have their worries, and they might go far beyond the fear of being eaten, or worries about finding their next meal.

It is known that stress can lower rates of reproduction in some animals, and -- here in the boreal forest -- some researchers think stress just might drive the ten-year cycle of snowshoe hares -- a phenomenon that is one of the major lynchpins and great mysteries of life in this part of the world.

Snowshoe hares might pass their stress levels on to their kids.

(photo: Government of Yukon)

An earlier study on hares found that they are more stressed when their populations are declining than when they hit the bottom of their population cycle. This most likely occurs because -- with fewer bunnies around -- the remaining ones are more at risk of being eaten by a hungry lynx or coyote.

Michael Sheriff, a UBC doctoral student, wants to take this work one step further to see whether stressed-out hares have fewer babies -- an effect that has never been documented in this species. Studying what is known as the "stress axis," he predicts that increasing stress levels among hares will cause reproduction to decrease. He also wants to study whether mother hares pass their stress levels on to their kids -- before they are even born.

Populations of both hares and predators have hit their lows and are starting to climb again, so once again hares must be constantly looking over their shoulders, on guard against ever-hungry predators. Sheriff is live-trapping hares in Kluane right now, trying to see whether their stress levels are also on the upswing.

And how, one might well ask, does one go about determining whether a snowshoe hare is stressed? Not so long ago, researchers had to take blood samples from the hares -- knowing that this very act could increase the animals' stress levels.

Sheriff is relying on a new technique known as fecal sampling. Instead of drawing blood, he collects the hare's fecal pellets, which are always in ready supply. Another advantage is that the pellets indicate the animal's stress levels 24 hours before they were trapped, when life was normal and so were their stress levels.

The main indicators of stress are glucocorticoid metabolites, which are produced by the stress hormone cortisol. "It's the hormone responsible for the "fight or flight response," explained Sheriff. While animals such as rats and mice product cortisone when stressed, both humans and hares produce cortisol -- which means that the hare research might also shed some light on human physiology.

Since the early 1970s researchers have been trying to figure out what drives the snowshoe hare cycle. They've looked at predators such as lynx and coyotes, whose numbers rise and fall along with those of the hares. They've tried to figure out whether food is the issue -- perhaps the bunnies eat themselves out of house and home.

But even when hares were kept in enclosures where they had plenty of food, and were protected from predators, the cycle still continued. Another mystery is the lag in the cycle; no one can explain why the number of hares stays low for a few years, even after the number of predators has dropped, and the vegetation has had a chance to replenish itself.

"Neither of these theories sufficiently explain the driving force of the cycle or why the population remains at a low level; there should not be a lag," said Sheriff.

He hopes that something called "maternal pre-programming" might explain the mysterious lag. Basically this means that mother hares pass on the dubious gift of stress to their unborn babies: if a mother hare is stressed, her hormones affect her fetus, and she gives birth to a stressed youngster.

Sheriff plans to compare the offspring of stressed and unstressed mothers to see whether stress levels are passed from one generation to the next.

"This has never been shown before," he said. "It is a brand new theory."

If his research shows that stressed hares have fewer babies, and that stressed mothers give birth to stressed young ones, this finding could explain the lag in the

hare cycle. "It may be due to the young having a reproductive output that would be good for the environment their mothers experienced," he explained.

His thinking goes like this: during downswings in the hare cycle, when hares are more at risk of being eaten, female hares might be much better off trying to avoid predators than trying to have lots of babies. If these stressed mothers pass their high levels of cortisol on to their kids, the next generation might also have a lower rate of reproduction, even if the hares are born at the bottom of the hare cycle when there are fewer predators.

If this is true, then bingo -- there is a lag in the cycle.

Sheriff says the study of stress levels is important because of the essential role that hares play in the food web of the boreal forest. If industrial development such as mining and logging continue to increase in this region, the stress levels of hares living in the boreal could increase as well. "If stress levels turn out to be a major determinant of reproduction, this could alter the whole ecosystem as hares are a keystone species in the boreal forest," he said.

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